The Australian Curriculum

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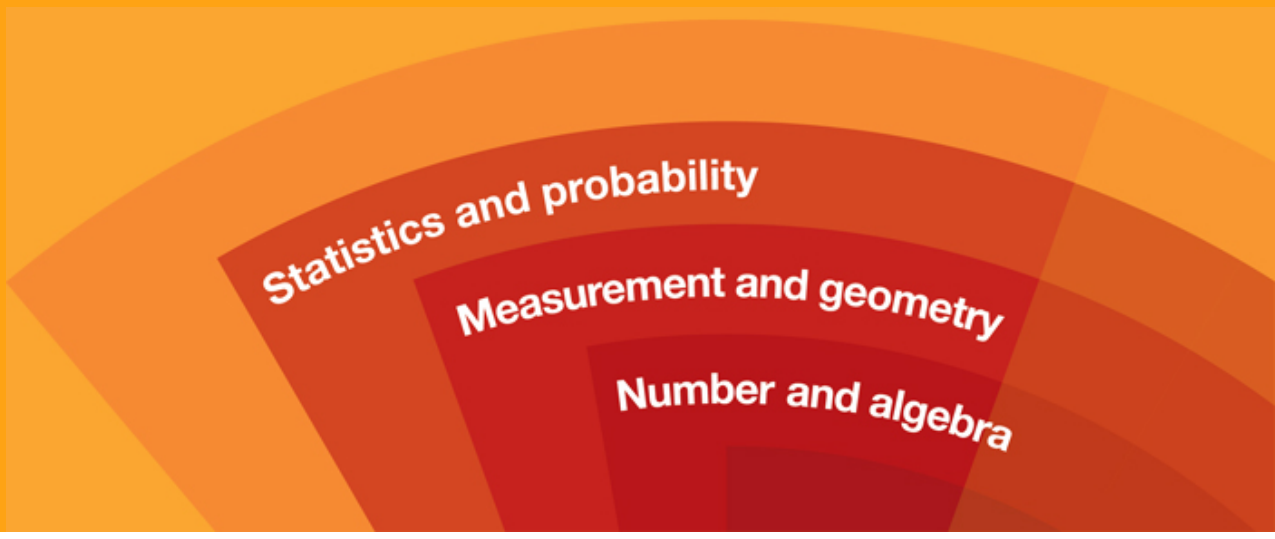

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Mathematics

Rationale

Learning mathematics creates opportunities for and enriches the lives of all Australians. The Australian Curriculum: Mathematics provides students with essential mathematical skills and knowledge in ***Number and Algebra***, ***Measurement and Geometry***, and ***Statistics and Probability***. It develops the numeracy capabilities that all students need in their personal, work and civic life, and provides the fundamentals on which mathematical specialties and professional applications of mathematics are built.

Mathematics has its own value and beauty and the Australian Curriculum: Mathematics aims to instil in students an appreciation of the elegance and power of mathematical reasoning. Mathematical ideas have evolved across all cultures over thousands of years, and are constantly developing. Digital technologies are facilitating this expansion of ideas and providing access to new tools for continuing mathematical exploration and invention. The curriculum focuses on developing increasingly sophisticated and refined mathematical understanding, fluency, logical reasoning, analytical thought and problem-solving skills. These capabilities enable students to respond to familiar and unfamiliar situations by employing mathematical strategies to make informed decisions and solve problems efficiently.

The Australian Curriculum: Mathematics ensures that the links between the various components of mathematics, as well as the relationship between mathematics and other disciplines, are made clear. Mathematics is composed of multiple but interrelated and interdependent concepts and systems which students apply beyond the mathematics classroom. In science, for example, understanding sources of error and their impact on the confidence of conclusions is vital, as is the use of mathematical models in other disciplines. In geography, interpretation of data underpins the study of human populations and their physical environments; in history, students need to be able to imagine timelines and time frames to reconcile related events; and in English, deriving quantitative and spatial information is an important aspect of making meaning of texts.

The curriculum anticipates that schools will ensure all students benefit from access to the power of mathematical reasoning and learn to apply their mathematical understanding creatively and efficiently. The mathematics curriculum provides students with carefully paced, in-depth study of critical skills and concepts. It encourages teachers to help students become self-motivated, confident learners through inquiry and active participation in challenging and engaging experiences.

Aims

The Australian Curriculum: Mathematics aims to ensure that students:

- are confident, creative users and communicators of mathematics, able to investigate, represent and interpret situations in their personal and work lives and as active citizens
- develop an increasingly sophisticated understanding of mathematical concepts and fluency with processes, and are able to pose and solve problems and reason in ***Number and Algebra, Measurement and Geometry, and Statistics and Probability***
- recognise connections between the areas of mathematics and other disciplines and appreciate mathematics as an accessible and enjoyable discipline to study.

Content structure

The Australian Curriculum: Mathematics is organised around the interaction of three content strands and four proficiency strands.

The content strands are ***Number and Algebra***, ***Measurement and Geometry***, and ***Statistics and Probability***. They describe what is to be taught and learnt.

The proficiency strands are ***Understanding***, ***Fluency***, ***Problem Solving***, and ***Reasoning***. They describe how content is explored or developed, that is, the thinking and doing of mathematics. They provide the language to build in the developmental aspects of the learning of mathematics and have been incorporated into the content descriptions of the three content strands described above. This approach has been adopted to ensure students' proficiency in mathematical skills develops throughout the curriculum and becomes increasingly sophisticated over the years of schooling.

Content strands

Number and Algebra

Number and Algebra are developed together, as each enriches the study of the other. Students apply number sense and strategies for counting and representing numbers. They explore the magnitude and properties of numbers. They apply a range of strategies for computation and understand the connections between operations. They recognise patterns and understand the concepts of variable and function. They build on their understanding of the number system to describe relationships and formulate generalisations. They recognise equivalence and solve equations and inequalities. They apply their number and algebra skills to conduct investigations, solve problems and communicate their reasoning.

Measurement and Geometry

Measurement and Geometry are presented together to emphasise their relationship to each other, enhancing their practical relevance. Students develop an increasingly sophisticated understanding of size, shape, relative position and movement of two-dimensional figures in the plane and three-dimensional objects in space. They investigate properties and apply their understanding of them to define, compare and construct figures and objects. They learn to develop geometric arguments. They make meaningful measurements of quantities, choosing appropriate metric units of measurement. They build an understanding of the connections between units and calculate derived measures such as area, speed and density.

Statistics and Probability

Statistics and Probability initially develop in parallel and the curriculum then progressively builds the links between them. Students recognise and analyse data and draw inferences. They represent, summarise and interpret data and undertake purposeful investigations involving the collection and interpretation of data. They assess likelihood and assign probabilities using experimental and theoretical approaches. They develop an increasingly sophisticated ability to critically evaluate chance and data concepts and make reasoned judgments and decisions, as well as building skills to critically evaluate statistical information and develop intuitions about data.

Proficiency strands

The proficiency strands describe the actions in which students can engage when learning and using the content. While not all proficiency strands apply to every content description, they indicate the breadth of mathematical actions that teachers can emphasise.

Understanding

Students build a robust knowledge of adaptable and transferable mathematical concepts. They make connections between related concepts and progressively apply the familiar to develop new ideas. They develop an understanding of the relationship between the 'why' and the 'how' of mathematics. Students build understanding when they connect related ideas, when they represent concepts in different ways, when they identify commonalities and differences between aspects of content, when they describe their thinking mathematically and when they interpret mathematical information.

Fluency

Students develop skills in choosing appropriate procedures, carrying out procedures flexibly, accurately, efficiently and appropriately, and recalling factual knowledge and concepts readily. Students are fluent when they calculate answers efficiently, when they recognise robust ways of answering questions, when they choose appropriate methods and approximations, when they recall definitions and regularly use facts, and when they can manipulate expressions and equations to find solutions.

Problem Solving

Students develop the ability to make choices, interpret, formulate, model and investigate problem situations, and communicate solutions effectively. Students formulate and solve problems when they use mathematics to represent unfamiliar or meaningful situations, when they design investigations and plan their approaches, when they apply their existing strategies to seek solutions, and when they verify that their answers are reasonable.

Reasoning

Students develop an increasingly sophisticated capacity for logical thought and actions, such as analysing, proving, evaluating, explaining, inferring, justifying and generalising. Students are reasoning mathematically when they explain their thinking, when they deduce and justify strategies used and conclusions reached, when they adapt the known to the unknown, when they transfer learning from one context to another, when they prove that something is true or false and when they compare and contrast related ideas and explain their choices.

Content descriptions

The mathematics curriculum includes content descriptions at each year level. These describe the knowledge, concepts, skills and processes that teachers are expected to teach and students are expected to learn. However, they do not prescribe approaches to teaching. The content descriptions are intended to ensure that learning is appropriately ordered and that unnecessary repetition is avoided. However, a concept or skill introduced at one year level may be revisited, strengthened and extended at later year levels as needed.

Sub-strands

Content descriptions are grouped into sub-strands to illustrate the clarity and sequence of development of concepts through and across the year levels. They support the ability to see the connections across strands and the sequential development of concepts from Foundation to Year 10.

Number and Algebra	Measurement and Geometry	Statistics and Probability

Number and place value (F-8)	***Using units of measurement (F-10)***	***Chance (1-10)***
Fractions and decimals (1-6)	***Shape (F-7)***	***Data representation and interpretation (F-10)***
Real numbers (7-10)	***Geometric reasoning (3-10)***	
Money and financial mathematics (1-10)	***Location and transformation (F-7)***	
Patterns and algebra (F-10)	***Pythagoras and trigonometry (9-10)***	
Linear and non-linear relationships (8-10)		

Year level descriptions

Year level descriptions emphasise the importance of working mathematically within the content. They provide an overview of the relationship between the proficiencies (***Understanding, Fluency, Problem Solving*** and ***Reasoning***) and the content for each year level.

Content elaborations

Content elaborations are provided for Foundation to Year 10 to illustrate and exemplify content and assist teachers to develop a common understanding of the content descriptions. They are not intended to be comprehensive content points that all students need to be taught.

Glossary

A glossary is provided to support the common understanding of key terms in the content descriptions.

This support document contains additional information to support the glossary.

Mathematics across Foundation to Year 12

Although the curriculum is described year by year, this document provides advice across four year groupings on the nature of learners and the relevant curriculum:

- Foundation – Year 2: typically students from 5 to 8 years of age
- Years 3–6: typically students from 8 to 12 years of age
- Years 7–10: typically students from 12 to 15 years of age
- Senior secondary years: typically students from 15 to 18 years of age.

Foundation – Year 2

The early years (5–8 years of age) lay the foundation for learning mathematics. Students at this level can access powerful mathematical ideas relevant to their current lives and learn the language of mathematics, which is vital to future progression.

Children have the opportunity to access mathematical ideas by developing a sense of number, order, sequence and pattern; by understanding quantities and their representations; by learning about attributes of objects and collections, position, movement and direction, and by developing an awareness of the collection, presentation and variation of data and a capacity to make predictions about chance events.

Understanding and experiencing these concepts in the early years provides a foundation for algebraic, statistical and multiplicative thinking, that will develop in subsequent years. These foundations also enable children to pose basic mathematical questions about their world, to identify simple strategies to investigate solutions, and to strengthen their reasoning to solve personally meaningful problems.

Years 3–6

These years emphasise the importance of students studying coherent, meaningful and purposeful mathematics that is relevant to their lives. Students still require active experiences that allow them to construct key mathematical ideas, but also gradually move to using models, pictures and symbols to represent these ideas.

The curriculum develops key understandings by extending the number, measurement, geometric and statistical learning from the early years; by building foundations for future studies through an emphasis on patterns that lead to generalisations; by describing relationships from data collected and represented; by making predictions; and by introducing topics that represent a key challenge in these years, such as fractions and decimals.

In these years of schooling, it is particularly important for students to develop a deep understanding of whole numbers to build reasoning in fractions and decimals and to develop a conceptual understanding of place value. These concepts allow students to develop proportional reasoning and flexibility with number through mental computation skills, and to extend their number sense and statistical fluency.

Years 7–10

These years of school mark a shift in mathematics learning to more abstract ideas. Through key activities such as the exploration, recognition and application of patterns, the capacity for abstract thought can be developed and the ways of thinking associated with abstract ideas can be illustrated.

The foundations built in previous years prepare students for this change. Previously established mathematical ideas can be drawn upon in unfamiliar sequences and combinations to solve non-routine problems and to consequently develop more complex mathematical ideas. However, students of this age also need an understanding of the connections between mathematical concepts and their application in their world as a motivation to learn. This means using contexts directly related to topics of relevance and interest to this age group.

During these years, students need to be able to represent numbers in a variety of ways; to develop an understanding of the benefits of algebra, through building algebraic models and applications and the various applications of geometry; to estimate and select appropriate units of measure; to explore ways of working with data to allow a variety of representations; and to make predictions about events based on their observations.

The intent of the curriculum is to encourage the development of important ideas in more depth, and to promote the interconnectedness of mathematical concepts. An obvious concern is the preparation of students intending to continue studying mathematics in the senior secondary years. Teachers will, in implementing the curriculum, extend the more mathematically able students by using appropriate challenges and extensions within available topics. A deeper understanding of mathematics in the curriculum enhances a student's potential to use this knowledge to solve non-routine problems, both at this level of study and at later stages.

The 10A content is optional and is intended for students who require more content to enrich their mathematical study whilst completing the common Year 10 content. It is NOT anticipated that all students will attempt the 10A content, but doing so would be advantageous for students intending to pursue Mathematical Methods (Course C) or Specialist Mathematics (Course D) in the senior secondary years. A selection of topics from the 10A curriculum can be completed according to the needs of the students.

It is anticipated that all students will study the Australian Curriculum: Mathematics up to the end of Year 10. From Year 10, the curriculum should provide pathway options suitable for students of differing abilities and interests, and with a range of future career and study plans.

Senior secondary years

Four mathematics courses have been designed for the senior secondary years. They have been designed to allow flexibility for students, taking into account a range of future pathways and the reality that some students reassess their choice of mathematics program part way through the senior secondary years.

The elements of the content strands from Foundation to Year 10 are evident in the senior secondary curriculum, but are not used as the major organisers. The proficiency strands of Understanding, Fluency, Reasoning and Problem Solving are integrated into the content descriptions as in the Foundation to Year 10 curriculum.

Achievement Standards

Across Foundation to Year 10, achievement standards indicate the quality of learning that students should typically demonstrate by a particular point in their schooling. Achievement standards comprise a written description and student work samples.

An achievement standard describes the quality of learning (the extent of knowledge, the depth of understanding, and the sophistication of skills) that would indicate the student is well placed to commence the learning required at the next level of achievement.

The sequence of achievement standards across Foundation to Year 10 describes progress in the learning area. This sequence provides teachers with a framework of growth and development in the learning area.

Student work samples play a key role in communicating expectations described in the achievement standards. Each work sample includes the relevant assessment task, the student's response, and annotations identifying the quality of learning evident in the student's response in relation to relevant parts of the achievement standard.

Together, the description of the achievement standard and the accompanying set of annotated work samples help teachers to make judgments about whether students have achieved the standard.

Diversity of Learners

Australian students have multiple, diverse, and changing needs that are shaped by individual learning histories and abilities as well as personal, cultural and language backgrounds and socio-economic factors.

ACARA is committed to the development of a high-quality curriculum for all Australian students that promotes excellence and equity in education. Teachers will use the Australian Curriculum to develop teaching and learning programs that build on student's current learning and which are not limited by an individual student's gender, language, sexual orientation, pregnancy, culture, ethnicity, religion, health or disability, socio economic background or geographic location.

The Australian Curriculum is shaped by the propositions that each student can learn and that the needs of every student are important. The flexibility offered by the Australian Curriculum enables teachers to plan rigorous, relevant and engaging learning and assessment experiences for all students

The Australian Curriculum sets out the sequence of learning typically expected across the years of schooling Foundation to Year 10. The curriculum content, presented as content descriptions, specifies the knowledge, understanding and skills that young people are to be taught and are expected to learn across the years of schooling F – 10. Teachers make flexible use of instructional processes and assessment strategies to ensure that all students are able to access, and engage with the Australian Curriculum in ways that are rigorous, relevant and meaningful. The achievement standards describe a broad sequence of expected learning in terms of what students are typically able to understand and able to do. Teachers use the achievement standards to locate the students' current levels of achievement and then plan programs that build on, and account for the different abilities of students, their prior learning experiences, cultural and linguistic backgrounds, and the different rates at which they learn.

Students with disability

ACARA acknowledges the Disability Discrimination Act (1992) (DDA) and the Disability Standards for Education (2005), and its obligation as an education and training service provider to articulate the rights of students with disability to access, participate and achieve in the curriculum on the same basis as students without disability.

The objectives of the Australian Curriculum are the same for all students. The curriculum offers flexibility for teachers to tailor their teaching in ways that provide rigorous, relevant and engaging learning and assessment opportunities for students with disability.

Students with disability can engage with the curriculum provided the necessary adjustments are made to the complexity of the curriculum content and to the means through which students demonstrate their knowledge, skills and understanding.

For some learners, making adjustments to instructional processes and to assessment strategies enables students to achieve educational standards commensurate with their peers.

For other students, teachers will need to make appropriate adjustments to the complexity of the curriculum content and by necessity, how the student's progress is monitored, assessed and reported.

English as an additional language or dialect

Many students in Australian schools are learners of English as an additional language or dialect (EAL/D). EAL/D students are those whose first language is a language other than Standard Australian English and who require additional support to assist them to develop English language proficiency.

EAL/D students come from diverse backgrounds and may include:

- overseas- and Australian-born students whose first language is a language other than English
- students whose first language is an Aboriginal or Torres Strait Islander language, including creoles and related varieties, or Aboriginal English.

EAL/D students enter Australian schools at different ages and at different stages of English language learning and have various educational backgrounds in their first languages. For some, school is the only place they use English.

The aims of the Australian Curriculum: Mathematics are ultimately the same for all students. However, EAL/D students are simultaneously learning a new language and the knowledge, understanding and skills of the Australian Curriculum: Mathematics through that new language. They require additional time and support, along with informed teaching that explicitly addresses their language needs, and assessments that take into account their developing language proficiency.

The ***English as an Additional Language or Dialect: Teacher Resource*** has been produced to support teachers as they develop teaching and learning programs using the Australian Curriculum. It describes four phases of language proficiency that will enable teachers to identify the typical language skills and understandings of their EAL/D students. Advice for teachers about cultural and linguistic considerations related to the Australian Curriculum: Mathematics and teaching strategies supportive of EAL/D students will help make the content of the curriculum accessible to EAL/D students. The EAL/D resource is available here.

General capabilities

In the Australian Curriculum, the general capabilities encompass the knowledge, skills, behaviours and dispositions that, together with curriculum content in each learning area and the cross-curriculum priorities, will assist students to live and work successfully in the twenty-first century.

There are seven general capabilities:

- Literacy
- Numeracy
- Information and communication technology (ICT) capability
- Critical and creative thinking
- Personal and social capability
- Ethical understanding
- Intercultural understanding.

In the Australian Curriculum: Mathematics, general capabilities are identified wherever they are developed or applied in content descriptions. They are also identified where they offer opportunities to add depth and richness to student learning through content elaborations. Icons indicate where general capabilities have been identified in Mathematics content. Teachers may find further opportunities to incorporate explicit teaching of the capabilities depending on their choice of activities.

Literacy

Students become literate as they develop the knowledge, skills and dispositions to interpret and use language confidently for learning and communicating in and out of school and for participating effectively in society. Literacy involves students in listening to, reading, viewing, speaking, writing and creating oral, print, visual and digital texts, and using and modifying language for different purposes in a range of contexts.

Literacy is an important aspect of mathematics. Students develop literacy in mathematics as they learn the vocabulary associated with number, space, measurement and mathematical concepts and processes. This vocabulary includes synonyms (minus, subtract), technical terminology (digits, lowest common denominator), passive voice (If 7 is taken from 10) and common words with specific meanings in a mathematical context (angle, area). They develop the ability to create and interpret a range of texts typical of Mathematics ranging from calendars and maps to complex data displays.

Students use literacy to understand and interpret word problems and instructions that contain the particular language features of mathematics. They use literacy to pose and answer questions, engage in mathematical problem solving, and to discuss, produce and explain solutions.

Numeracy

Students become numerate as they develop the knowledge and skills to use mathematics confidently across all learning areas at school and in their lives more broadly. Numeracy involves students in recognising and understanding the role of mathematics in the world and having the dispositions and capacities to use mathematical knowledge and skills purposefully.

Mathematics has a central role in the development of numeracy in a manner that is more explicit and foregrounded than is the case in other learning areas. It is important that the Mathematics curriculum provides the opportunity to apply mathematical understanding and skills in context, both in other learning areas and in real world contexts. A particularly important context for the application of ***Number and Algebra*** is financial mathematics. In ***Measurement and Geometry***, there is an opportunity to apply understanding to design. The twenty-first century world is information driven, and through ***Statistics and Probability*** students can interpret data and make informed judgments about events involving chance.

Information and Communication Technology (ICT) capability

Students develop ICT capability as they learn to use ICT effectively and appropriately to access, create and communicate information and ideas, solve problems and work collaboratively in all learning areas at school, and in their lives beyond school. ICT capability involves students in learning to make the most of the technologies available to them, adapting to new ways of doing things as technologies evolve and limiting the risks to themselves and others in a digital environment.

Students develop ICT capability when they investigate, create and communicate mathematical ideas and concepts using fast, automated, interactive and multimodal technologies. They employ their ICT capability to perform calculations, draw graphs, collect, manage, analyse and interpret data; share and exchange information and ideas and investigate and model concepts and relationships.

Digital technologies, such as spreadsheets, dynamic geometry software and computer algebra software, can engage students and promote understanding of key concepts.

Critical and creative thinking

Students develop capability in critical and creative thinking as they learn to generate and evaluate knowledge, clarify concepts and ideas, seek possibilities, consider alternatives and solve problems. Critical and creative thinking are integral to activities that require students to think broadly and deeply using skills, behaviours and dispositions such as reason, logic, resourcefulness, imagination and innovation in all learning areas at school and in their lives beyond school.

Students develop critical and creative thinking as they learn to generate and evaluate knowledge, ideas and possibilities, and use them when seeking solutions. Engaging students in reasoning and thinking about solutions to problems and the strategies needed to find these solutions are core parts of the Mathematics curriculum.

Students are encouraged to be critical thinkers when justifying their choice of a calculation strategy or identifying relevant questions during a statistical investigation. They are encouraged to look for alternative ways to approach mathematical problems, for example, identifying when a problem is similar to a previous one, drawing diagrams or simplifying a problem to control some variables.

Personal and social capability

Students develop personal and social capability as they learn to understand themselves and others, and manage their relationships, lives, work and learning more effectively. The personal and social capability involves students in a range of practices including recognising and regulating emotions, developing empathy for and understanding of others, establishing positive relationships, making responsible decisions, working effectively in teams and handling challenging situations constructively.

Students develop and use personal and social capability as they apply mathematical skills in a range of personal and social contexts. This may be through activities that relate learning to their own lives and communities, such as time management, budgeting and financial management, and understanding statistics in everyday contexts.

The Mathematics curriculum enhances the development of students' personal and social capabilities by providing opportunities for initiative taking, decision making, communicating their processes and findings, and working independently and collaboratively in the Mathematics classroom.

Ethical understanding

Students develop ethical understanding as they identify and investigate the nature of ethical concepts, values, character traits and principles, and understand how reasoning can assist ethical judgment. Ethical understanding involves students in building a strong personal and socially oriented ethical outlook that helps them to manage context, conflict and uncertainty, and to develop an awareness of the influence that their values and behaviour have on others.

There are opportunities in the Mathematics curriculum to explore, develop and apply ethical understanding in a range of contexts, for example through analysing data and statistics; seeking intentional and accidental distortions; finding inappropriate comparisons and misleading scales when exploring the importance of fair comparison; and interrogating financial claims and sources.

Intercultural understanding

Students develop intercultural understanding as they learn to value their own cultures, languages and beliefs, and those of others. They come to understand how personal, group and national identities are shaped, and the variable and changing nature of culture. The capability involves students in learning about and engaging with diverse cultures in ways that recognise commonalities and differences, create connections with others and cultivate mutual respect.

Intercultural understanding can be enhanced in Mathematics when students are exposed to a range of cultural traditions. Students learn to understand that mathematical expressions use universal symbols, while mathematical knowledge has its origin in many cultures. Students realise that proficiencies such as understanding, fluency, reasoning and problem solving are not culture or language specific, but that mathematical reasoning and understanding can find different expression in different cultures and languages. New technologies and digital learning environments provide interactive contexts for exploring mathematical problems from a range of cultural perspectives and within diverse cultural contexts. Students can apply mathematical thinking to identify and resolve issues related to living with diversity.

Cross-curriculum priorities

There are three Cross-curriculum priorities in the Australian Curriculum:

- Aboriginal and Torres Strait Islander histories and cultures
- Asia and Australia's engagement with Asia
- Sustainability.

The Cross-curriculum priorities are embedded in the curriculum and will have a strong but varying presence depending on their relevance to each of the learning areas.

Aboriginal and Torres Strait Islander histories and cultures

Aboriginal and Torres Strait Islander communities are strong, rich and diverse. Aboriginal and Torres Strait Islander Identity is central to this priority and is intrinsically linked to living, learning Aboriginal and Torres Strait Islander communities, deep knowledge traditions and holistic world view.

A conceptual framework based on Aboriginal and Torres Strait Islander Peoples' unique sense of Identity has been developed as a structural tool for the embedding of Aboriginal and Torres Strait Islander histories and cultures within the Australian curriculum. This sense of Identity is approached through the interconnected aspects of Country/Place, People and Culture. Embracing these elements enhances all areas of the curriculum.

The Aboriginal and Torres Strait Islander priority provides opportunities for all learners to deepen their knowledge of Australia by engaging with the world's oldest continuous living cultures. This knowledge and understanding will enrich their ability to participate positively in the ongoing development of Australia.

The Australian Curriculum: mathematics values Aboriginal and Torres Strait Islander histories and cultures. It provides opportunities for students to appreciate that Aboriginal and Torres Strait Islander societies have sophisticated applications of mathematical concepts.

Students will explore connections between representations of number and pattern and how they relate to aspects of Aboriginal and Torres Strait Islander cultures. They will investigate time, place, relationships and measurement concepts in Aboriginal and Torres Strait Islander contexts. Students will deepen their understanding of the lives of Aboriginal and Torres Strait Islander Peoples through the application and evaluation of statistical data.

Asia and Australia's engagement with Asia

In the Australian Curriculum: Mathematics, the priority of Asia and Australia's engagement with Asia provides rich and engaging contexts for developing students' mathematical knowledge, skills and understanding.

The Australian Curriculum: Mathematics provides opportunities for students to learn about the understandings and applications of Mathematics in Asia. Mathematicians from Asia continue to contribute to the ongoing development of Mathematics.

In this learning area, students develop mathematical understanding in fields such as number, patterns, measurement, symmetry and statistics by drawing on knowledge of and examples from the Asia region. These could include calculation, money, art, architecture, design and travel. Investigations involving data collection, representation and analysis can be used to examine issues pertinent to the Asia region.

Sustainability

In the Australian Curriculum: Mathematics, the priority of sustainability provides rich, engaging and authentic contexts for developing students' abilities in number and algebra, measurement and geometry, and statistics and probability.

The Australian Curriculum: Mathematics provides opportunities for students to develop the proficiencies of problem solving and reasoning essential for the exploration of sustainability issues and their solutions. Mathematical understandings and skills are necessary to measure, monitor and quantify change in social, economic and ecological systems over time. Statistical analysis enables prediction of probable futures based on findings and helps inform decision making and actions that will lead to preferred futures.

In this learning area, students can observe, record and organise data collected from primary sources over time and analyse data relating to issues of sustainability from secondary sources. They can apply spatial reasoning, measurement, estimation, calculation and comparison to gauge local ecosystem health and can cost proposed actions for sustainability.

Learning in mathematics involves the use of knowledge and skills learnt in other areas, particularly in English, science and history.

The Australian National Numeracy Review Report (2008) identified numeracy as requiring an across-the-school commitment, including mathematical, strategic and contextual aspects. This across-the-school commitment can be managed by including specific references to other curriculum areas in the mathematics curriculum, and the identification of key numeracy capacities in the descriptions of other curriculum areas being developed. For example, the following are some of the numeracy perspectives that could be relevant to English, science and history.

English

One aspect of the link with English and literacy is that, along with other elements of study, numeracy can be understood and acquired only within the context of the social, cultural, political, economic and historical practices to which it is integral. Students need to be able to draw on quantitative and spatial information to derive meaning from certain types of texts encountered in the subject of English.

Science

Practical work and problem solving across all the sciences require the capacity to organise and represent data in a range of forms; plot, interpret and extrapolate graphs; estimate and solve ratio problems; use formulas flexibly in a range of situations; perform unit conversions; and use and interpret rates including concentrations, sampling, scientific notation, and significant figures.

History

Learning in history includes interpreting and representing large numbers and a range of data such as those associated with population statistics and growth, financial data, figures for exports and imports, immigration statistics, mortality rates, war enlistments and casualty figures; chance events, correlation and causation; imagining timelines and time frames to reconcile related events; and the perception and spatial visualisation required for geopolitical considerations, such as changes in borders of states and in ecology.

Implications for teaching, assessment and reporting

In mathematics, challenging problems can be posed using basic age-appropriate content. Accelerating students by using content beyond their year level may not be the best way to extend proficient mathematicians. Choosing engaging experiences as contexts for a variety of tasks assists in making mathematics inclusive, and these tasks can be effectively differentiated both for students experiencing difficulty and those who complete tasks easily. The proficiency strands apply expectations of the range and nature of how mathematical content is enacted, and can help focus teaching.

Teachers use the Australian Curriculum content and achievement standards first to identify current levels of learning and achievement and then to select the most appropriate content (possibly from across several year levels) to teach individual students and/or groups of students. This takes into account that in each class there may be students with a range of prior achievement (below, at, and above the year level expectations) and that teachers plan to build on current learning.

Teachers also use the achievement standards, at the end of a period of teaching, to make on-balance judgments about the quality of learning demonstrated by the students – that is whether they have achieved below, at, or above the standard. To make these judgments, teachers draw on assessment data that they have collected as evidence during the course of the teaching period. These judgments about the quality of learning are one source of feedback to students and their parents and inform formal reporting processes.

If a teacher judges that a student's achievement is below the expected standard, this suggests that the teaching programs and practice should be reviewed to better assist individual students in their learning in the future. It also suggests that additional support and targeted teaching will be needed to ensure that the student does not fall behind.

Assessment of the Australian Curriculum takes place in different levels and for different purposes, including:

- ongoing formative assessment within classrooms for the purposes of monitoring learning and providing feedback, to teachers to inform their teaching, and for students to inform their learning
- summative assessment for the purposes of twice-yearly reporting by schools to parents and carers on the progress and achievement of students
- annual testing of Years 3, 5, 7 and 9 students' levels of achievement in aspects of literacy and numeracy, conducted as part of the National Assessment Program – Literacy and Numeracy (NAPLAN)
- periodic sample testing of specific learning areas within the Australian Curriculum as part of the National Assessment Program (NAP).

Year 9

The proficiency strands ***Understanding, Fluency, Problem Solving and Reasoning*** are an integral part of mathematics content across the three content strands: ***Number and Algebra, Measurement and Geometry, and Statistics and Probability.*** The proficiencies reinforce the significance of working mathematically within the content and describe how the content is explored or developed. They provide the language to build in the developmental aspects of the learning of mathematics.

At this year level:

Understanding includes describing the relationship between graphs and equations, simplifying a range of algebraic expressions, explaining the use of relative frequencies to estimate probabilities, and the use of the trigonometric ratios for right-angle triangles

Fluency includes applying the index laws to expressions with integer indices, expressing numbers in scientific notation, listing outcomes for experiments and developing familiarity with calculations involving the Cartesian plane and calculating areas of shapes and surface areas of prisms

Problem Solving includes formulating, and modelling practical situations involving surface areas and volumes of right prisms, applying ratio and scale factors to similar figures, solving problems involving right-angle trigonometry, and collecting data from secondary sources to investigate an issue

Reasoning includes following mathematical arguments, evaluating media reports and using statistical knowledge to clarify situations, developing strategies in investigating similarity and sketching linear graphs

Year 9 Content Descriptions

Number and Algebra	
Real numbers	**Elaborations**
Solve problems involving direct proportion. Explore the relationship between graphs and equations corresponding to simple rate problems (ACMNA208)	• identifying direct proportion in real-life contexts
Apply index laws to numerical expressions with integer indices (ACMNA209)	• simplifying and evaluating numerical expressions, using involving both positive and negative integer indices

Express numbers in scientific notation (ACMNA210) 	• representing extremely large and small numbers in scientific notation, and numbers expressed in scientific notation as whole numbers or decimals

Money and financial mathematics	Elaborations
Solve problems involving simple interest (ACMNA211) 	• understanding that financial decisions can be assisted by mathematical calculations

Patterns and algebra	Elaborations
Extend and apply the index laws to variables, using positive integer indices and the zero index (ACMNA212) 	• understanding that index laws apply to variables as well as numbers
Apply the distributive law to the expansion of algebraic expressions, including binomials, and collect like terms where appropriate (ACMNA213) 	• understanding that the distributive law can be applied to algebraic expressions as well as numbers • understanding the relationship between expansion and factorisation and identifying algebraic factors in algebraic expressions

Linear and non-linear relationships	Elaborations
Find the distance between two points located on a Cartesian plane using a range of strategies, including graphing software (ACMNA214) 	• investigating graphical and algebraic techniques for finding distance between two points • using Pythagoras' theorem to calculate distance between two points
Find the midpoint and gradient of a line segment (interval) on the Cartesian plane using a range of strategies, including graphing software (ACMNA294) 	• investigating graphical and algebraic techniques for finding midpoint and gradient • recognising that the gradient of a line is the same as the gradient of any line segment on that line

Sketch linear graphs using the coordinates of two points and solve linear equations (ACMNA215) 	• determining linear rules from suitable diagrams, tables of values and graphs and describing them using both words and algebra
Graph simple non-linear relations with and without the use of digital technologies and solve simple related equations (ACMNA296) 	• graphing parabolas, and circles connecting x-intercepts of a graph to a related equation

Measurement and Geometry

Using units of measurement	Elaborations
Calculate the areas of composite shapes (ACMMG216) 	• understanding that partitioning composite shapes into rectangles and triangles is a strategy for solving problems involving area
Calculate the surface area and volume of cylinders and solve related problems (ACMMG217) 	• analysing nets of cylinders to establish formulas for surface area • connecting the volume and capacity of a cylinder to solve authentic problems
Solve problems involving the surface area and volume of right prisms (ACMMG218) 	• solving practical problems involving surface area and volume of right prisms
Investigate very small and very large time scales and intervals (ACMMG219) 	• investigating the usefulness of scientific notation in representing very large and very small numbers

Geometric reasoning	Elaborations

Use the enlargement transformation to explain similarity and develop the conditions for triangles to be similar (ACMMG220) 	• establishing the conditions for similarity of two triangles and comparing this to the conditions for congruence • using the properties of similarity and ratio, and correct mathematical notation and language, to solve problems involving enlargement (for example, scale diagrams) • using the enlargement transformation to establish similarity understanding that similarity and congruence help describe relationships between geometrical shapes and are important elements of reasoning and proof
Solve problems using ratio and scale factors in similar figures (ACMMG221) 	• establishing the relationship between areas of similar figures and the ratio of corresponding sides (scale factor)

Pythagoras and trigonometry	Elaborations
Investigate Pythagoras' Theorem and its application to solving simple problems involving right angled triangles (ACMMG222) 	• understanding that Pythagoras' Theorem is a useful tool in determining unknown lengths in right-angled triangles and has widespread applications • recognising that right-angled triangle calculations may generate results that can be integers, fractions or irrational numbers
Use similarity to investigate the constancy of the sine, cosine and tangent ratios for a given angle in right-angled triangles (ACMMG223) 	• developing understanding of the relationship between the corresponding sides of similar right-angled triangles
Apply trigonometry to solve right-angled triangle problems (ACMMG224) 	• understanding the terms 'adjacent' and 'opposite' sides in a right-angled triangle • selecting and accurately using the correct trigonometric ratio to find unknown sides (adjacent, opposite and hypotenuse) and angles in right-angled triangles

Statistics and Probability

Chance	Elaborations
List all outcomes for two-step chance experiments, both with and without replacement using tree diagrams or arrays. Assign probabilities to outcomes and determine probabilities for events (ACMSP225) 	• conducting two-step chance experiments • using systematic methods to list outcomes of experiments and to list outcomes favourable to an event • comparing experiments which differ only by being undertaken with replacement or without replacement
Calculate relative frequencies from given or collected data to estimate probabilities of events involving 'and' or 'or' (ACMSP226) 	• using Venn diagrams or two-way tables to calculate relative frequencies of events involving ‘and’, ‘or’ questions • using relative frequencies to find an estimate of probabilities of ‘and’, ‘or’ events
Investigate reports of surveys in digital media and elsewhere for information on how data were obtained to estimate population means and medians (ACMSP227) 	• investigating a range of data and its sources, for example the age of residents in Australia, Cambodia and Tonga; the number of subjects studied at school in a year by 14-year-old students in Australia, Japan and Timor-Leste

Data representation and interpretation	Elaborations
Identify everyday questions and issues involving at least one numerical and at least one categorical variable, and collect data directly and from secondary sources (ACMSP228) 	• comparing the annual rainfall in various parts of Australia, Pakistan, New Guinea and Malaysia
Construct back-to-back stem-and-leaf plots and histograms and describe data, using terms including ‘skewed’, ‘symmetric’ and ‘bi modal’ (ACMSP282) 	• using stem-and-leaf plots to compare two like sets of data such as the heights of girls and the heights of boys in a class • describing the shape of the distribution of data using terms such as ‘positive skew’, ‘negative skew’ and 'symmetric' and 'bi-modal'

Compare data displays using mean, median and range to describe and interpret numerical data sets in terms of location (centre) and spread (ACMSP283) 	• comparing means, medians and ranges of two sets of numerical data which have been displayed using histograms, dot plots, or stem and leaf plots

Year 9 Achievement Standard

By the end of Year 9, students solve problems involving simple interest. They interpret ratio and scale factors in similar figures. Students explain similarity of triangles. They recognise the connections between similarity and the trigonometric ratios. Students compare techniques for collecting data in primary and secondary sources. They make sense of the position of the mean and median in skewed, symmetric and bi-modal displays to describe and interpret data.

Students apply the index laws to numbers and express numbers in scientific notation. They expand binomial expressions. They find the distance between two points on the Cartesian plane and the gradient and midpoint of a line segment. They sketch linear and non-linear relations. Students calculate areas of shapes and the volume and surface area of right prisms and cylinders. They use Pythagoras' Theorem and trigonometry to find unknown sides of right-angled triangles. Students calculate relative frequencies to estimate probabilities, list outcomes for two-step experiments and assign probabilities for those outcomes. They construct histograms and back-to-back stem-and-leaf plots.

Mathematics Scope and Sequence: Foundation to Year 6

		Foundation Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Number and Algebra	Number and place value	Establish understanding of the language and processes of counting by naming numbers in sequences, initially to and from 20, moving from any starting point Connect number names, numerals and quantities, including zero, initially up to 10 and then beyond Subitise small collections of objects Represent practical situations to model addition and sharing Compare, order and make correspondences between collections, initially to 20, and explain reasoning	Develop confidence with number sequences to and from 100 by ones from any starting point. Skip count by twos, fives and tens starting from zero Recognise, model, read, write and order numbers to at least 100. Locate these numbers on a number line Count collections to 100 by partitioning numbers using place value Represent and solve simple addition and subtraction problems using a range of strategies including counting on, partitioning and rearranging parts	Investigate number sequences, initially those increasing and decreasing by twos, threes, fives and ten from any starting point, then moving to other sequences. Recognise, model, represent and order numbers to at least 1000 Group, partition and rearrange collections up to 1000 in hundreds, tens and ones to facilitate more efficient counting Explore the connection between addition and subtraction Solve simple addition and subtraction problems using a range of efficient mental and written strategies Recognise and represent multiplication as repeated addition, groups and arrays Recognise and represent division as grouping into equal sets and solve simple problems using these representations	Investigate the conditions required for a number to be odd or even and identify odd and even numbers Recognise, model, represent and order numbers to at least 10 000 Apply place value to partition, rearrange and regroup numbers to at least 10 000 to assist calculations and solve problems Recognise and explain the connection between addition and subtraction Recall addition facts for single-digit numbers and related subtraction facts to develop increasingly efficient mental strategies for computation Recall multiplication facts of two, three, five and ten and related division facts Represent and solve problems involving multiplication using efficient mental and written strategies and appropriate digital technologies	Recall multiplication facts up to 10 _ 10 and related division facts Investigate and use the properties of odd and even numbers Recognise, represent and order numbers to at least tens of thousands Apply place value to partition, rearrange and regroup numbers to at least tens of thousands to assist calculations and solve problems Investigate number sequences involving multiples of 3, 4, 6, 7, 8, and 9 Develop efficient mental and written strategies and use appropriate digital technologies for multiplication and for division where there is no remainder	Identify and describe factors and multiples of whole numbers and use them to solve problems Use estimation and rounding to check the reasonableness of answers to calculations Solve problems involving multiplication of large numbers by one- or two-digit numbers using efficient mental, written strategies and appropriate digital technologies Solve problems involving division by a one digit number, including those that result in a remainder Use efficient mental and written strategies and apply appropriate digital technologies to solve problems	Identify and describe properties of prime, composite, square and triangular numbers Select and apply efficient mental and written strategies and appropriate digital technologies to solve problems involving all four operations with whole numbers Investigate everyday situations that use integers. Locate and represent these numbers on a number line
	Fractions and decimals		Recognise and describe one-half as one of two equal parts of a whole.	Recognise and interpret common uses of halves, quarters and eighths of shapes and collections	Model and represent unit fractions including 1/2, 1/4, 1/3, 1/5 and their multiples to a complete whole	Investigate equivalent fractions used in contexts Count by quarters halves and thirds, including with mixed numerals. Locate and represent these fractions on a number line Recognise that the place value system can be extended to tenths and hundredths. Make connections between fractions and decimal notation	Compare and order common unit fractions and locate and represent them on a number line Investigate strategies to solve problems involving addition and subtraction of fractions with the same denominator Recognise that the place value system can be extended beyond hundredths Compare, order and represent decimals	Compare fractions with related denominators and locate and represent them on a number line Solve problems involving addition and subtraction of fractions with the same or related denominators Find a simple fraction of a quantity where the result is a whole number, with and without digital technologies Add and subtract decimals, with and without digital technologies, and use estimation and rounding to check the reasonableness of answers Multiply decimals by whole numbers and perform divisions by non-zero whole numbers where the results are terminating decimals, with and without digital technologies Multiply and divide decimals by powers of 10 Make connections between equivalent fractions, decimals and percentages
	Real numbers	This sequence ends at Year 7						

Mathematics Scope and Sequence: Year 6 to Year 10

		Year 6	Year 7	Year 8	Year 9	Year 10	Year 10 A
Number and Algebra	Number and place value	Identify and describe properties of prime, composite, square and triangular numbers Select and apply efficient mental and written strategies and appropriate digital technologies to solve problems involving all four operations with whole numbers Investigate everyday situations that use positive and negative whole numbers and zero. Locate and represent these numbers on a number line	Investigate index notation and represent whole numbers as products of powers of prime numbers Investigate and use square roots of perfect square numbers Apply the associative, commutative and distributive laws to aid mental and written computation Compare, order, add and subtract integers	Use index notation with numbers to establish the index laws with positive integral indices and the zero index Carry out the four operations with rational numbers and integers, using efficient mental and written strategies and appropriate digital technologies	This sequence ends at this year level		
	Fractions and decimals	Compare fractions with related denominators and locate and represent them on a number line Solve problems involving addition and subtraction of fractions with the same or related denominators Find a simple fraction of a quantity where the result is a whole number, with and without digital technologies Add and subtract decimals, with and without digital technologies, and use estimation and rounding to check the reasonableness of answers Multiply decimals by whole numbers and perform divisions that result in terminating decimals, with and without digital technologies Multiply and divide decimals by powers of 10 Make connections between equivalent fractions, decimals and percentages	This sequence ends at Year 6				
	Real numbers	This sequence starts at Year 7	Compare fractions using equivalence. Locate and represent positive and negative fractions and mixed numbers on a number line Solve problems involving addition and subtraction of fractions, including those with unrelated denominators Multiply and divide fractions and decimals using efficient written strategies and digital technologies Express one quantity as a fraction of another, with and without the use of digital technologies Round decimals to a specified number of decimal places Connect fractions, decimals and percentages and carry out simple conversions Find percentages of quantities and express one quantity as a percentage of another, with and without digital technologies. Recognise and solve problems involving simple ratios	Investigate terminating and recurring decimals Investigate the concept of irrational numbers, including π Solve problems involving the use of percentages, including percentage increases and decreases, with and without digital technologies Solve a range of problems involving rates and ratios, with and without digital technologies	Solve problems involving direct proportion. Explore the relationship between graphs and equations corresponding to simple rate problems Apply index laws to numerical expressions with integer indices Express numbers in scientific notation		Define rational and irrational numbers and perform operations with surds and fractional indices Use the definition of a logarithm to establish and apply the laws of logarithms

Mathematics Scope and Sequence: Foundation to Year 6

		Foundation Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Number and Algebra	Money and financial mathematics		Recognise, describe and order Australian coins according to their value	Count and order small collections of Australian coins and notes according to their value	Represent money values in multiple ways and count the change required for simple transactions to the nearest five cents	Solve problems involving purchases and the calculation of change to the nearest five cents with and without digital technologies	Create simple financial plans	Investigate and calculate percentage discounts of 10%, 25% and 50% on sale items, with and without digital technologies
	Patterns and algebra	Sort and classify familiar objects and explain the basis for these classifications. Copy, continue and create patterns with objects and drawings	Investigate and describe number patterns formed by skip counting and patterns with objects	Describe patterns with numbers and identify missing elements Solve problems by using number sentences for addition or subtraction	Describe, continue, and create number patterns resulting from performing addition or subtraction	Explore and describe number patterns resulting from performing multiplication Solve word problems by using number sentences involving multiplication or division where there is no remainder Use equivalent number sentences involving addition and subtraction to find unknown quantities	Describe, continue and create patterns with fractions, decimals and whole numbers resulting from addition and subtraction Use equivalent number sentences involving multiplication and division to find unknown quantities	Continue and create sequences involving whole numbers, fractions and decimals. Describe the rule used to create the sequence Explore the use of brackets and order of operations to write number sentences
	Linear and non-linear relationships							This sequence starts at Year 7

Mathematics Scope and Sequence: Year 6 to Year 10

		Year 6	Year 7	Year 8	Year 9	Year 10	Year 10 A
Number and Algebra	Money and financial mathematics	Investigate and calculate percentage discounts of 10%, 25% and 50% on sale items, with and without digital technologies	Investigate and calculate 'best buys', with and without digital technologies	Solve problems involving profit and loss, with and without digital technologies	Solve problems involving simple interest	Connect the compound interest formula to repeated applications of simple interest using appropriate digital technologies	
	Patterns and algebra	Continue and create sequences involving whole numbers, fractions and decimals. Describe the rule used to create the sequence Explore the use of brackets and order of operations to write number sentences	Introduce the concept of variables as a way of representing numbers using letters Create algebraic expressions and evaluate them by substituting a given value for each variable Extend and apply the laws and properties of arithmetic to algebraic terms and expressions	Extend and apply the distributive law to the expansion of algebraic expressions Factorise algebraic expressions by identifying numerical factors Simplify algebraic expressions involving the four operations	Extend and apply the index laws to variables, using positive integer indices and the zero index Apply the distributive law to the expansion of algebraic expressions, including binomials, and collect like terms where appropriate	Factorise algebraic expressions by taking out a common algebraic factor Simplify algebraic products and quotients using index laws Apply the four operations to simple algebraic fractions with numerical denominators Expand binomial products and factorise monic quadratic expressions using a variety of strategies Substitute values into formulas to determine an unknown	Investigate the concept of a polynomial and apply the factor and remainder theorems to solve problems
	Linear and non-linear relationships	This sequence starts at Year 7	Given coordinates, plot points on the Cartesian plane, and find coordinates for a given point Solve simple linear equations Investigate, interpret and analyse graphs from authentic data	Plot linear relationships on the Cartesian plane with and without the use of digital technologies Solve linear equations using algebraic and graphical techniques. Verify solutions by substitution	Find the distance between two points located on a Cartesian plane using a range of strategies, including graphing software Sketch linear graphs using the coordinates of two points and solve linear equations Find the midpoint and gradient of a line segment (interval) on the Cartesian plane using a range of strategies, including graphing software Graph simple non-linear relations with and without the use of digital technologies and solve simple related equations	Solve problems involving linear equations, including those derived from formulas Solve linear inequalities and graph their solutions on a number line Solve linear simultaneous equations, using algebraic and graphical techniques including using digital technology Solve problems involving parallel and perpendicular lines Explore the connection between algebraic and graphical representations of relations such as simple quadratics, circles and exponentials using digital technology as appropriate Solve linear equations involving simple algebraic fractions Solve simple quadratic equations using a range of strategies	Describe, interpret and sketch parabolas, hyperbolas, circles and exponential functions and their transformations Solve simple exponential equations Apply understanding of polynomials to sketch a range of curves and describe the features of these curves from their equation Factorise monic and non-monic quadratic expressions and solve a wide range of quadratic equations derived from a variety of contexts

Mathematics Scope and Sequence: Foundation to Year 6

		Foundation Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Measurement and Geometry	Using units of measurement	Use direct and indirect comparisons to decide which is longer, heavier or holds more, and explain reasoning in everyday language Compare and order the duration of events using the everyday language of time Connect days of the week to familiar events and actions	Measure and compare the lengths and capacities of pairs of objects using uniform informal units Tell time to the half-hour Describe duration using months, weeks, days and hours	Compare and order several shapes and objects based on length, area, volume and capacity using appropriate uniform informal units Compare masses of objects using balance scales Tell time to the quarter-hour, using the language of 'past' and 'to' Name and order months and seasons Use a calendar to identify the date and determine the number of days in each month	Measure, order and compare objects using familiar metric units of length, mass and capacity Tell time to the minute and investigate the relationship between units of time	Use scaled instruments to measure and compare lengths, masses, capacities and temperatures Convert between units of time Use am and pm notation and solve simple time problems Compare objects using familiar metric units of area and volume	Choose appropriate units of measurement for length, area, volume, capacity and mass Calculate the perimeter and area of rectangles using familiar metric units Compare 12- and 24-hour time systems and convert between them	Connect decimal representations to the metric system Convert between common metric units of length, mass and capacity Solve problems involving the comparison of lengths and areas using appropriate units Connect volume and capacity and their units of measurement Interpret and use timetables
	Shape	Sort, describe and name familiar two-dimensional shapes and three-dimensional objects in the environment	Recognise and classify familiar two-dimensional shapes and three-dimensional objects using obvious features	Describe and draw two-dimensional shapes, with and without digital technologies Describe the features of three-dimensional objects	Make models of three-dimensional objects and describe key features	Compare the areas of regular and irregular shapes by informal means Compare and describe two dimensional shapes that result from combining and splitting common shapes, with and without the use of digital technologies	Connect three-dimensional objects with their nets and other two-dimensional representations	Construct simple prisms and pyramids
	Location and transformation	Describe position and movement	Give and follow directions to familiar locations	Interpret simple maps of familiar locations and identify the relative positions of key features Investigate the effect of one-step slides and flips with and without digital technologies Identify and describe half and quarter turns	Create and interpret simple grid maps to show position and pathways Identify symmetry in the environment	Use simple scales, legends and directions to interpret information contained in basic maps Create symmetrical patterns, pictures and shapes with and without digital technologies	Use a grid reference system to describe locations. Describe routes using landmarks and directional language Describe translations, reflections and rotations of two-dimensional shapes. Identify line and rotational symmetries Apply the enlargement transformation to familiar two dimensional shapes and explore the properties of the resulting image compared with the original	Investigate combinations of translations, reflections and rotations, with and without the use of digital technologies Introduce the Cartesian coordinate system using all four quadrants
	Geometric reasoning	This sequence starts at Year 3			Identify angles as measures of turn and compare angle sizes in everyday situations	Compare angles and classify them as equal to, greater than or less than a right angle	Estimate, measure and compare angles using degrees. Construct angles using a protractor	Investigate, with and without digital technologies, angles on a straight line, angles at a point and vertically opposite angles. Use results to find unknown angles
	Pythagoras and trigonometry	This sequence starts at Year 9						

Mathematics Scope and Sequence: Year 6 to Year 10

		Year 6	Year 7	Year 8	Year 9	Year 10	Year 10 A
Measurement and Geometry	Using units of measurement	Connect decimal representations to the metric system Convert between common metric units of length, mass and capacity Solve problems involving the comparison of lengths and areas using appropriate units Connect volume and capacity and their units of measurement Interpret and use timetables	Establish the formulas for areas of rectangles, triangles and parallelograms and use these in problem solving Calculate volumes of rectangular prisms	Choose appropriate units of measurement for area and volume and convert from one unit to another Find perimeters and areas of parallelograms, trapeziums, rhombuses and kites Investigate the relationship between features of circles such as circumference, area, radius and diameter. Use formulas to solve problems involving circumference and area Develop the formulas for volumes of rectangular and triangular prisms and prisms in general. Use formulas to solve problems involving volume Solve problems involving duration, including using 12- and 24-hour time within a single time zone	Calculate the areas of composite shapes Find perimeters and areas of parallelograms, trapeziums, rhombuses and kites Solve problems involving the surface area and volume of right prisms Investigate very small and very large time scales and intervals	Solve problems involving surface area and volume for a range of prisms, cylinders and composite solids	Solve problems involving surface area and volume of right pyramids, right cones, spheres and related composite solids
	Shape	Construct simple prisms and pyramids	Draw different views of prisms and solids formed from combinations of prisms	This sequence ends at Year 7			
	Location and transformation	Investigate combinations of translations, reflections and rotations, with and without the use of digital technologies Introduce the Cartesian coordinate system using all four quadrants	Describe translations, reflections in an axis, and rotations of multiples of 90° on the Cartesian plane using coordinates. Identify line and rotational symmetries	This sequence ends at Year 7			
	Geometric reasoning	Investigate, with and without digital technologies, angles on a straight line, angles at a point and vertically opposite angles. Use results to find unknown angles	Identify corresponding, alternate and co-interior angles when two straight lines are crossed by a transversal Investigate conditions for two lines to be parallel and solve simple numerical problems using reasoning Classify triangles according to their side and angle properties and describe quadrilaterals Demonstrate that the angle sum of a triangle is 180° and use this to find the angle sum of a quadrilateral	Define congruence of plane shapes using transformations Develop the conditions for congruence of triangles Establish properties of quadrilaterals using congruent triangles and angle properties, and solve related numerical problems using reasoning	Use the enlargement transformation to explain similarity and develop the conditions for triangles to be similar Solve problems using ratio and scale factors in similar figures	Formulate proofs involving congruent triangles and angle properties Apply logical reasoning, including the use of congruence and similarity, to proofs and numerical exercises involving plane shapes	Prove and apply angle and chord properties of circles
	Pythagoras and trigonometry			This sequence starts at Year 9	Investigate Pythagoras' Theorem and its application to solving simple problems involving right angled triangles Use similarity to investigate the constancy of the sine, cosine and tangent ratios for a given angle in right-angled triangles Apply trigonometry to solve right-angled triangle problems	Solve right-angled triangle problems including those involving direction and angles of elevation and depression	Establish the sine, cosine and area rules for any triangle and solve related problems Use the unit circle to define trigonometric functions, and graph them with and without the use of digital technologies Solve simple trigonometric equations Apply Pythagoras' theorem and trigonometry to solving three-dimensional problems in right-angled triangles

Mathematics Scope and Sequence: Foundation to Year 6

		Foundation Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Statistics and Probability	Chance		Identify outcomes of familiar events involving chance and describe them using everyday language such as 'will happen', 'won't happen' or 'might happen'	Identify practical activities and everyday events that involve chance. Describe outcomes as 'likely' or 'unlikely' and identify some events as 'certain' or 'impossible'	Conduct chance experiments, identify and describe possible outcomes and recognise variation in results	Describe possible everyday events and order their chances of occurring Identify everyday events where one cannot happen if the other happens Identify events where the chance of one will not be affected by the occurrence of the other	List outcomes of chance experiments involving equally likely outcomes and represent probabilities of those outcomes using fractions Recognise that probabilities range from 0 to 1	Describe probabilities using fractions, decimals and percentages Conduct chance experiments with both small and large numbers of trials using appropriate digital technologies Compare observed frequencies across experiments with expected frequencies
	Data representation and interpretation	Answer yes/no questions to collect information	Choose simple questions and gather responses Represent data with objects and drawings where one object or drawing represents one data value. Describe the displays	Identify a question of interest based on one categorical variable. Gather data relevant to the question Collect, check and classify data Create displays of data using lists, table and picture graphs and interpret them	Identify questions or issues for categorical variables. Identify data sources and plan methods of data collection and recording Collect data, organise into categories and create displays using lists, tables, picture graphs and simple column graphs, with and without the use of digital technologies Interpret and compare data displays	Select and trial methods for data collection, including survey questions and recording sheets Construct suitable data displays, with and without the use of digital technologies, from given or collected data. Include tables, column graphs and picture graphs where one picture can represent many data values Evaluate the effectiveness of different displays in illustrating data features including variability	Pose questions and collect categorical or numerical data by observation or survey Construct displays, including column graphs, dot plots and tables, appropriate for data type, with and without the use of digital technologies Describe and interpret different data sets in context	Interpret and compare a range of data displays, including side-by-side column graphs for two categorical variables Interpret secondary data presented in digital media and elsewhere

		Year 6	Year 7	Year 8	Year 9	Year 10	Year 10 A
Statistics and Probability	Chance	Describe probabilities using fractions, decimals and percentages Conduct chance experiments with both small and large numbers of trials using appropriate digital technologies Compare observed frequencies across experiments with expected frequencies	Construct sample spaces for single-step experiments with equally likely outcomes Assign probabilities to the outcomes of events and determine probabilities for events	Identify complementary events and use the sum of probabilities to solve problems Describe events using language of 'at least', exclusive 'or' (A or B but not both), inclusive 'or' (A or B or both) and 'and'. Represent events in two-way tables and Venn diagrams and solve related problems	List all outcomes for two-step chance experiments, both with and without replacement using tree diagrams or arrays. Assign probabilities to outcomes and determine probabilities for events Calculate relative frequencies from given or collected data to estimate probabilities of events involving 'and' or 'or' Investigate reports of surveys in digital media and elsewhere for information on how data were obtained to estimate population means and medians	Describe the results of two- and three-step chance experiments, both with and without replacements, assign probabilities to outcomes and determine probabilities of events. Investigate the concept of independence Use the language of 'if ....then, 'given', 'of', 'knowing that' to investigate conditional statements and identify common mistakes in interpreting such language	Investigate reports of studies in digital media and elsewhere for information on their planning and implementation
	Data representation and interpretation	Interpret and compare a range of data displays, including side-by-side column graphs for two categorical variables Interpret secondary data presented in digital media and elsewhere	Identify and investigate issues involving numerical data collected from primary and secondary sources Construct and compare a range of data displays including stem-and-leaf plots and dot plots Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of data Describe and interpret data displays using median, mean and range	Explore the practicalities and implications of obtaining data through sampling using a variety of investigative processes Investigate the effect of individual data values , including outliers, on the mean and median Explore the variation of means and proportions in of random samples drawn from the same population Investigate techniques for collecting data, including census ,sampling and observation.	Identify everyday questions and issues involving at least one numerical and at least one categorical variable, and collect data directly from secondary sources Construct back-to-back stem-and-leaf plots and histograms and describe data, using terms including 'skewed', 'symmetric' and 'bi modal' Compare data displays using mean, median and range to describe and interpret numerical data sets in terms of location (centre) and spread Investigate techniques for collecting data, including census, sampling and observation	Determine quartiles and interquartile range Construct and interpret box plots and use them to compare data sets Compare shapes of box plots to corresponding histograms and dot plots Use scatter plots to investigate and comment on relationships between two numerical variables Investigate and describe bivariate numerical data where the independent variable is time Evaluate statistical reports in the media and other places by linking claims to displays, statistics and representative data	Calculate and interpret the mean and standard deviation of data and use these to compare data sets Use information technologies to investigate bivariate numerical data sets. Where appropriate use a straight line to describe the relationship allowing for variation